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(54) Rotary-drum laundry dryer

(57) Rotary-drum laundry dryer (1) comprising a revolving drum (3) adapted to receive laundry to be dried, a hot-air generator (6) structured to circulate an airflow (f) through said revolving drum (3), and a lower supporting base or socle (9) which is structured for resting on the floor and for housing at least part of the hot-air generator (6); the hot-air generator (6) comprising: an air recirculating conduit (12) allowing said airflow (f) to flow through the revolving drum (3) and through at least one heat exchanger (15) located along said air recirculating conduit (12) for condensing moisture inside the airflow (f); a segment (12c) of the air recirculating conduit (12) extending across the lower supporting base or socle (9), and being structured so as to house said at least one heat exchanger (15); said lower supporting base or socle (9) being furthermore provided with one or more pass-through openings (19a) through which corresponding elongated members (19) stick out of said segment (12c) of the air recirculating conduit (12); the laundry dryer (1) also comprising an auxiliary lid or cover (9c) which is structured for being associated onto the lower supporting base or socle (9), in a region adjacent to at least one of said pass-through openings (19a), to at least partly cover/close the gap formed between the edge of the lower supporting base or socle (9) delimiting said pass-through opening (19a) and the at least one elongated member (19) that sticks out of the lower supporting base or socle (9) through said pass-through opening (19a).

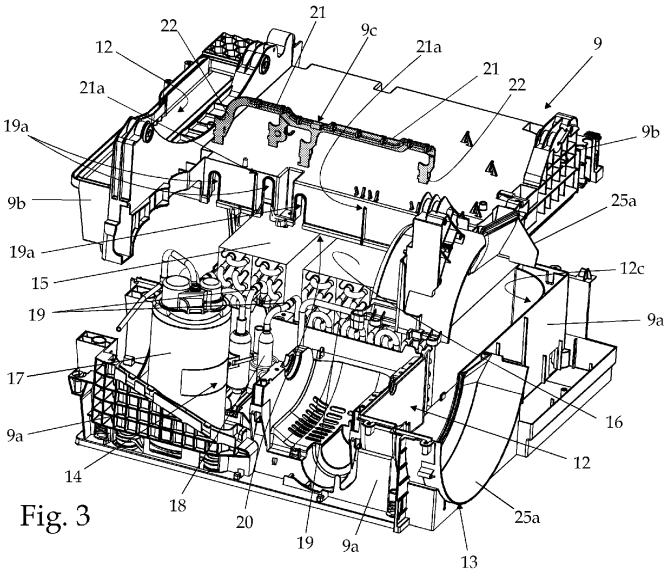

Fig. 3

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Description

[0001] The present invention relates to a rotary-drum laundry dryer.

[0002] In particular, the present invention relates to a rotary-drum home laundry dryer, to which the following description refers purely by way of example without implying any loss of generality.

[0003] As is known, today's rotary-drum home laundry dryers comprise: a substantially parallelepiped-shaped outer boxlike casing structured for resting on the floor; a substantially cylindrical revolving drum structured for housing the laundry to be dried, and which is housed in axially rotating manner inside the casing to rotate about its horizontally-oriented longitudinal axis, directly facing a laundry loading/unloading opening formed in the front wall of the casing; a porthole door hinged to the front wall of the casing to rotate to and from a closing position in which the door rests completely against the front wall of the casing to close the laundry loading/ unloading opening and airtight seal the revolving drum; and an electric motor assembly structured for driving into rotation the revolving drum about its longitudinal axis inside the casing.

[0004] Home laundry dryers of the above type are also provided with an open-circuit or closed-circuit, hot-air generator which is structured to circulate inside the revolving drum a stream of hot air having a low moisture content, and which flows through the revolving drum and over the laundry inside the drum to rapidly dry the laundry; and with an electronic central control unit which controls both the motor assembly and the hot-air generator to perform one of the user-selectable drying cycles stored in the same central control unit.

[0005] In today's high-end rotary-drum home laundry dryers, the hot-air generator is usually a closed-circuit, heat-pump type, hot-air generator that comprises: an air recirculating conduit having its two ends fluidly connected to the revolving drum, on opposite sides of the latter; a fan located along the air recirculating conduit to produce, inside the latter, an airflow which flows through the revolving drum; and finally a heat-pump assembly having its two heat exchangers located one after the other, along the air recirculating conduit.

[0006] EP-2034084 discloses a heat-pump type, rotary-drum home laundry dryer having a closed-circuit, heat-pump type, hot-air generator of the type referred above.

[0007] Since the two air/refrigerant heat exchangers of the heat-pump type, hot-air generator are housed inside the air recirculating conduit, one downstream the other, whereas the refrigerant compressing device and the refrigerant expansion device of the heat-pump type, hot-air generator are located outside the air recirculating conduit, several pass-through openings are formed on the lateral wall of the air recirculating conduit to allow the passage of a number of connecting pipes that channel the refrigerant to and from the air/refrigerant heat exchangers. Unluckily, these pass-through openings cause significant leaks of drying process air.

[0008] Aim of the present invention is to simplify the structure of today's laundry dryers, so to simplify the assembly of the laundry dryer and to improve efficiency of the closed-circuit, heat-pump type, hot-air generator.

[0009] A Further aim of the present invention is to significantly reduce the leaks of drying process air.

[0010] In compliance with the above aims, according to the present invention there is provided a rotary-drum laundry dryer comprising a revolving drum adapted to receive laundry to be dried, a hot-air generator structured to circulate an airflow through said revolving drum, and a lower supporting base or socle which is structured for resting on the floor and for housing at least part of the hot-air generator;

the hot-air generator comprising: an air recirculating conduit allowing said airflow to flow through the revolving drum and through at least one heat exchanger located along said air recirculating conduit for condensing moisture inside the airflow;

a segment of the air recirculating conduit extending across the lower supporting base or socle, and being structured so as to house said at least one heat exchanger; said lower supporting base or socle being furthermore provided with one or more pass-through openings through which corresponding elongated members stick out of said segment of the air recirculating conduit;

the laundry dryer being characterized by comprising an auxiliary lid or cover which is structured for being associated onto the lower supporting base or socle, in a region adjacent to at least one of said pass-through openings, to at least partly cover/close the gap formed between the edge of the lower supporting base or socle delimiting said pass-through opening and the at least one elongated member that sticks out of the lower supporting base or socle through said pass-through opening.

[0011] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said auxiliary lid or cover is shaped so to at least partly surround/embrace, when fixed on the lower supporting base or socle, the at least one elongated member that sticks out of the corresponding pass-through opening.

[0012] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said auxiliary lid or cover is shaped/structured to cover all pass-through openings on the lower supporting base or socle, to at least partly cover/close the gap formed between the edge of the lower supporting base or socle delimiting each pass-through opening and the at least one elongated member that sticks out of the lower supporting base or socle through the corresponding pass-through opening.

[0013] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said auxiliary lid or cover is associated to the lower supporting base or socle via snap-on locking means.

[0014] Furthermore and preferably, though not neces-

sarily, the rotary-drum laundry dryer is characterized in that the lower supporting base or socle comprises a lower half-shell which is structured for resting on the floor, and at least one upper half-shell which is structured/ shaped for being stacked up on top of, and rigidly coupled to, said lower half-shell, so to form at least a portion of said segment of the air recirculating conduit; the pass-through openings of the lower supporting base or socle consisting in one or more pass-through slots or recesses made on the lower half-shell and/or on the at least one upper half-shell, along a coupling edge between said half-shells.

[0015] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the lower half-shell and the at least one upper half-shell are made of plastic material via an injection molding process.

[0016] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said auxiliary lid or cover comprises an elongated plate element which is structured for being fixed on the outer surface of the lower supporting base or socle, immediately upwards and crosswise of a plurality of pass-through openings of the lower supporting base or socle; and a number of substantially hook-shaped winglets each of which protrudes from said elongated plate element towards a corresponding beneath-located pass-through opening, and is shaped to at least partly surround/embrace the elongated member that sticks out of said beneath-located pass-through opening.

[0017] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that a side edge of the elongated plate element of said auxiliary lid or cover is insertable into a number of vertical pass-through slits or grooves made on top end of a number of protruding appendixes that jut out from the lower supporting base or socle.

[0018] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the elongated plate element of said auxiliary lid or cover also comprises a number of substantially hook-shaped clip means that protrude from a same face of the elongated plate element.

[0019] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that at least one of the hook-shaped winglets of said auxiliary lid or cover is provided with one or more snap-on locking splines that protrudes from the distal end of the winglet main body remaining locally substantially perpendicular to the reference laying plane of the same winglet; each locking spline is shaped to hook onto the side edge of the lower supporting base or socle delimiting the pass-through opening to be closed, so as to hold the hook-shaped winglet locally adherent to the outer surface of the lower supporting base or socle.

[0020] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said auxiliary lid or cover is made of plastic material by an injection molding process.

[0021] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the hot-air generator is a heat-pump type, hot-air generator which comprises:

- a first air/refrigerant heat exchanger which is located inside said segment of the air recirculating conduit, and is structured for rapidly cooling down the airflow arriving from the revolving drum to condense and restrain the surplus moisture in the airflow;
- a second air/refrigerant heat exchanger which is located inside said segment of the air recirculating conduit, downstream of the first air/refrigerant heat exchanger, and which is structured for rapidly heating the airflow arriving from the first air/refrigerant heat exchanger and directed back to the revolving drum;
- a refrigerant compressing device which is interposed between the refrigerant-outlet of the first air/refrigerant heat exchanger and the refrigerant-inlet of the second air/refrigerant heat exchanger, and which is structured for compressing the gaseous-state refrigerant directed towards the second air/refrigerant heat exchanger; and
- a refrigerant expansion device which is interposed between the refrigerant-outlet of the second air/refrigerant heat exchanger and the refrigerant-inlet of the first air/refrigerant heat exchanger, and it is structured so as to cause a rapid expansion of the refrigerant directed towards the first air/refrigerant heat exchanger.

[0022] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said heat-pump type, hot-air generator furthermore comprises a number of connecting pipes that connect the first heat exchanger, the second heat exchanger, the refrigerant compressing device and the refrigerant expansion device to one another; and that at least one of said elongated member consists in one of said connecting pipes

[0023] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that at least one of said elongated member consists in an electric wire or similar that sticks out of the lower supporting base or socle through a pass-though opening.

[0024] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that at least one of said elongated member consists in a sensor, probe and/or other oblong element that extend in pass-through manner across a corresponding pass-through opening.

[0025] A non-limiting embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

- Figure 1 shows in perspective view, and with parts removed for clarity, a rotary-drum home laundry dryer realized in accordance with the teachings of the

present invention;

- Figure 2 shows in perspective view, and with parts removed for clarity, the lower supporting base or socle of the Figure 1 laundry-dryer, with parts removed for clarity;
- Figures 3 and 4 are two partly-exploded perspective views of the lower supporting base or socle of the Figure 1 laundry-dryer, with parts removed for clarity;
- Figure 5 is an enlarged view of part of the Figure 2 lower supporting base or socle of the laundry-dryer; whereas
- Figure 6 is an perspective view of a component part of the laundry-dryer lower supporting base or socle shown in Figures 2, 3 and 5.

[0026] With reference to Figure 1, number 1 indicates as a whole a preferably household, rotary-drum laundry dryer which comprises:

- a preferably, though not necessarily, parallelepiped-shaped outer boxlike casing 2 structured for resting on the floor;
- a substantially cylindrical, revolving drum 3 structured for housing the laundry to be dried, and which is fixed in axially rotating manner inside the boxlike casing 2, directly facing a laundry loading/ unloading through opening formed in the front wall of casing 2; and
- a porthole door 4 hinged to the front wall of casing 2 to rotate about a preferably, though not necessarily, vertically-oriented reference axis, to and from a closing position in which the door 4 rests completely against the front wall to close the laundry loading/ unloading opening and substantially airtight seal the revolving drum 3.

[0027] Inside the boxlike casing 2, the rotary-drum laundry dryer 1 additionally comprises an electric motor 5 which is mechanically connected to the revolving drum 3 for driving into rotation the drum 3 about its longitudinal axis; a closed-circuit, hot-air generator 6 which is structured to circulate through the revolving drum 3 a stream of hot air having a low moisture level, and which flows over and rapidly dries the laundry located inside drum 3; and finally an electronic central control unit 7 which controls both the electric motor 5 and the hot-air generator 6 to perform one of the user-selectable drying cycles preferably, though not necessarily, stored in the same central control unit 7.

[0028] With reference to Figures 1 and 2, the boxlike casing 2 preferably comprises a substantially parallelepiped-shaped lower supporting base or socle 9 which is structured for resting on the floor and for housing at least part of the hot-air generator 6; and a substantially parallelepiped-shaped upper boxlike cabinet 10 which is rigidly fixed to the top of the lower supporting base or socle 9 and it is structured so as to house the revolving drum 3.

[0029] In the example shown, in particular, the revolving drum 3 preferably extends inside the boxlike cabinet 10 coaxial to a substantially horizontally-oriented longitudinal reference axis L, and rests on a number of substantially horizontally-oriented, front and rear idle supporting rollers 11 which are located in pairs substantially at the two axial ends of the revolving drum 3, and are fixed in free revolving manner to the casing 2 so as to allow the revolving drum 3 to freely rotate about its reference axis L inside the boxlike cabinet 10.

[0030] With reference to Figures 1 and 2, the front and rear idle supporting rollers 11 are preferably fixed in free revolving manner directly on top of the lower supporting base or socle 9.

[0031] The laundry loading/unloading opening of casing 2 is therefore realized in the front wall of the upper boxlike cabinet 10, and the porthole door 4 is hinged to the front wall of the aforesaid upper boxlike cabinet 10.

[0032] In addition to the above, the lower supporting base or socle 9 is also preferably structured so to directly support the electric motor 5.

[0033] With reference to Figures 1, 2, 3 and 4, the closed-circuit, hot-air generator 6 instead preferably consists in a heat-pump type, hot-air generator 6 which is structured for gradually drawing air from revolving drum 3; rapidly cooling down the air arriving from revolving drum 3 so to extract and retain the surplus moisture in the air drawn from revolving drum 3; rapidly heating the dehumidified air to a predetermined temperature, normally higher than the temperature of the air from revolving drum 3; and finally feeding the heated, dehumidified air back into the revolving drum 3, where it flows over the laundry inside the drum to rapidly dry said laundry.

[0034] In other words, the hot-air generator 6 provides for continually dehumidifying and heating the air circulating inside revolving drum 3 to rapidly dry the laundry inside the drum, and basically comprises:

- an air recirculating conduit 12 having its two ends in communication with, i.e. flowingly/ fluidly connected to, the revolving drum 3 on opposite sides of the latter;
- a centrifugal fan 13 which is located along the air recirculating conduit 12 to produce, inside the air recirculating conduit 12, an airflow f which flows through the revolving drum 3, over the laundry located inside the drum 3; and
- a heat-pump assembly 14 which is able to rapidly cool the airflow f coming out from revolving drum 3 for condensing and retaining the surplus moisture in the airflow f, and then to rapidly heat the airflow f returning back into revolving drum 3, so that the airflow f re-entering into revolving drum 3 is rapidly heated to a temperature higher than or equal to that of the airflow f coming out of the drum.

[0035] In the example shown, in particular, the first mouth or inlet (not shown) of the air recirculating conduit 12 is preferably integrated in the preferably substantially

circular-shaped frame of the boxlike cabinet 10 that defines/delimits the laundry loading/unloading opening. The porthole door 4, when arranged in the closing position, abuts on this peripheral frame so as to substantially airtight seal the laundry loading/unloading opening and, at the same time, put/leave the aforesaid first mouth or inlet of the air recirculating conduit 12 in direct communication with the inside of revolving drum 3. The second mouth or outlet (not shown) of the air recirculating conduit 12 is instead preferably realized/ integrated in the rear wall of the upper boxlike cabinet 10, approximately at the center of the rear rim of revolving drum 3.

[0036] With reference to Figures 2, 3 and 4, the heat-pump assembly 14 in turn comprises:

- a first air/refrigerant heat exchanger 15 which is located along the air recirculating conduit 12 and is structured for rapidly cooling down the airflow f arriving from revolving drum 3 to condense and restrain the surplus moisture in the airflow f;
- a second air/refrigerant heat exchanger 16 which is located along the air recirculating conduit 12, downstream of heat exchanger 15, and which is structured for rapidly heating the airflow f arriving from heat exchanger 15 and directed back to revolving drum 3, so that the airflow f re-entering into revolving drum 3 is heated rapidly to a temperature higher than or equal to that of the air flowing out of revolving drum 3;
- an electrically-powered refrigerant compressing device 17 which is interposed between the refrigerant-outlet of heat exchanger 15 and the refrigerant-inlet of heat exchanger 16, and which is structured for compressing the gaseous-state refrigerant directed towards heat exchanger 16 so that refrigerant pressure and temperature are much higher at the refrigerant-inlet of heat exchanger 16 than at the refrigerant-outlet of heat exchanger 15; and
- an expansion valve or similar passive/operated refrigerant expansion device 18 (for example a capillary tube, a thermostatic valve or an electrically-controlled expansion valve) which is interposed between the refrigerant-outlet of heat exchanger 16 and the refrigerant-inlet of heat exchanger 15, and it is structured so as to cause a rapid expansion of the refrigerant directed towards the first air/refrigerant heat exchanger 15, so that refrigerant pressure and temperature are much higher at the refrigerant-outlet of heat exchanger 16 than at the refrigerant-inlet of heat exchanger 15.

[0037] Heat-pump assembly 14 is further provided with a number of connecting pipes 19 which connect the two heat exchangers 15 and 16, the refrigerant compressing device 17 and the refrigerant expansion device 18 to one another, so as to allow the refrigerant to continuously flow in closed loop from the refrigerant compressing device 17 in sequence to the second air/refrigerant heat exchanger 16, to the refrigerant expansion device 18, to the first air/refrigerant heat exchanger 15, and finally return back to the refrigerant compressing device 17.

[0038] The air/refrigerant heat exchanger 15 is conventionally referred to as the "evaporator" or "gas-heater" of the heat-pump assembly 14, and it is structured so that the airflow f arriving from revolving drum 3 and the low-pressure and low-temperature refrigerant directed to the suction of the refrigerant compressing device 17 can flow through it simultaneously, allowing the refrigerant having a temperature lower than that of the airflow f, to absorb heat from the airflow f, thus causing condensation of the surplus moisture in the airflow f arriving from revolving drum 3.

[0039] The air/refrigerant heat exchanger 16, in turn, is conventionally referred to as the "condenser" or "gas-cooler" of the heat-pump assembly 14, and it is structured so that the airflow f directed back into revolving drum 3 and the high-pressure and high-temperature refrigerant arriving from the delivery of the refrigerant compressing device 17 can flow through it simultaneously, allowing the refrigerant having a temperature greater than that of the airflow f to release heat to the airflow f, thus rapidly heating the airflow f directed back into the revolving drum 3.

[0040] With reference to Figures 3 and 4, in the example shown, in particular, a central/intermediate segment 12c of the air recirculating conduit 12 extends in pass-through manner across the lower supporting base or socle 9, and the evaporator 15 and condenser 16 of heat-pump assembly 14 are fitted/recessed, one downstream the other along the flowing direction of the airflow f, into said central/intermediate segment 12c of the air recirculating conduit 12. The central/intermediate segment 12c is therefore shaped/dimensioned so as to house both the evaporator 15 and the condenser 16 of the heat-pump assembly 14.

[0041] In the example shown, the central/ intermediate segment 12c of the air recirculating conduit 12 preferably extends inside the lower supporting base or socle 9 substantially horizontally.

[0042] Instead the refrigerant compressing device 17 and the refrigerant expansion device 18 of heat-pump assembly 14 are preferably fixed/recessed on the lower supporting base or socle 9, beside the central/intermediate segment 12c of the air recirculating conduit 12.

[0043] With reference to Figures 1 and 4, the centrifugal fan 13 of hot-air generator 6, in turn, is preferably located outside of the lower supporting base or socle 9, preferably at one of the two end-openings of the central/intermediate segment 12c of air recirculating conduit 12, so to directly communicate with, i.e. be flowingly/ fluidly connected to, both the central segment 12c of the air recirculating conduit 12 and the inside of revolving drum 3.

[0044] In the example shown, the centrifugal fan 13 is preferably located on the back of the lower supporting base or socle 9, at the exit end-opening or outlet of the central/intermediate segment 12c of the air recirculating

conduit 12, i.e. downstream of both evaporator 15 and condenser 16 of heat-pump assembly 14.

[0045] In addition to the above, with reference to Figures 2, 3 and 4, the lower supporting base or socle 9 of outer casing 2 is preferably formed/composed by a lower half-shell 9a which is structured for resting on the floor, and by an upper half-shell 9b which in turn is structured for being stacked up on top of, and rigidly coupled to, the lower half-shell 9a, so to preferably directly support the upper boxlike cabinet 10 and preferably also the front and rear idle rollers 11 that support in free revolving manner the revolving drum 3.

[0046] The lower half-shell 9a and the upper half-shell 9b are furthermore shaped so as to form, when coupled to one another, substantially the whole central/intermediate segment 12c of the air recirculating conduit 12 which houses, one downstream the other along the flowing direction of the airflow f, both the evaporator 15 and the condenser 16 of the heat-pump assembly 14.

[0047] In the example shown, the lower half-shell 9a and the upper half-shell 9b are preferably structured/ shaped so as to firmly and unremovably jam/ block in between themselves the evaporator 15 and the condenser 16 of heat-pump assembly 14 when coupled to one another to form/compose the lower supporting base or socle 9 of outer casing 2.

[0048] In other words, the lower half-shell 9a and upper half-shell 9b are shaped so as to form the two halves of the central segment 12c of the air recirculating conduit 12, and are structured for being substantially airtight coupled to one another, so as to compose/form the whole central segment 12c of the air recirculating conduit 12, and contemporaneously directly lock/ensnare in between themselves the evaporator 15 and the condenser 16.

[0049] In the example shown, the lower half-shell 9a and the upper half-shell 9b are both preferably, though not necessarily, made of plastic material preferably by means of an injection molding process.

[0050] With reference to Figures 2, 3 and 5, the lower supporting base or socle 9 is furthermore provided with one or more pass-through openings 19a through which corresponding connecting pipes 19 of the heat-pump assembly 14 stick out of the lower supporting base or socle 9, i.e. out of the central/intermediate segment 12c of the air recirculating conduit 12, to connect the evaporator 15 and condenser 16 to the other devices of heat-pump assembly 14. The laundry dryer 1 is additionally provided with an auxiliary lid or cover 9c which is structured for being associated on the lower supporting base or socle 9, immediately above at least one of the aforesaid pass-through openings 19a, to at least partly cover/close the gap formed between the edge of the lower supporting base or socle 9 delimiting the pass-through opening 19a and the at least one connecting pipe 19 that sticks out of the lower supporting base or socle 9 through the aforesaid pass-through opening 19a. This auxiliary lid or cover 9c serves to prevent/ minimize the air leakages through the gaps formed between the edge of the lower supporting base or socle 9 delimiting the pass-through opening 19a and the at least one connecting pipe 19 that sticks out from the same pass-through opening 19a.

[0051] The auxiliary lid or cover 9c is shaped so as to at least partly surround/embrace, when fixed on the lower supporting base or socle 9 immediately above at least one of the aforesaid pass-through openings 19a formed on the lower supporting base or socle 9, the at least one connecting pipe 19 that sticks out of said corresponding pass-through opening 19a, to at least partly cover/close the corresponding gap between the connecting pipe 19 and the body of the lower supporting base or socle 9.

[0052] Preferably, though not necessarily, the auxiliary lid or cover 9c is furthermore removably fixable onto the lower supporting base or socle 9 via snap-on locking means.

[0053] With reference to Figure 3, in the example shown, at least one between the lower half-shell 9a and the upper half-shell 9b has, along the coupling edge with the other complementary half-shell, a number of transversal pass-through slots or recesses 19a which are suitably dimensioned for being engaged in pass-through manner by the connecting pipes 19 of heat-pump assembly 14 that connect the air/refrigerant heat exchangers 15 and 16 to the refrigerant compressing device 17 and the refrigerant expansion device 18. The lower supporting base or socle 9 comprises an auxiliary lid or cover 9c which is structured for being fixed onto the lower half-shell 9a and/or the upper half-shell 9b, immediately above at least one of the pass-through slots or recesses 19a made on said half-shell 9a, 9b, to at least partly cover/ close the gap formed between the edge of the half-shell 9a, 9b delimiting the aforesaid pass-through slot or recess 19a and the at least one connecting pipe 19 that sticks out of the same pass-through slot or recess 19a.

[0054] The auxiliary lid or cover 9c is shaped so as to at least partly surround/embrace, when fixed on half-shells 9a and/or 9b immediately above at least one of the pass-through slot or recess 19a made on said half-shell 9a, 9b, the at least one connecting pipe 19 that sticks out of said pass-through slot or recess 19a, to at least partly cover/close the corresponding gap between the connecting pipe 19 and the local edge of the half-shell 9a, 9b.

[0055] The auxiliary lid or cover 9c is preferably to be fixed onto the lower half-shell 9a and/or the upper half-shell 9b, after the lower half-shell 9a and the upper half-shell 9b have been coupled to one another to form/ compose the central/intermediate segment 12c of the air recirculating conduit 12 that houses evaporator 15 and condenser 16 of the heat-pump assembly 14.

[0056] In addition to the above, with reference to Figures 2, 3 and 5, in the example shown the auxiliary lid or cover 9c is preferably, though not necessarily, shaped so to at least partly cover/close all the pass-through openings 19a made on the lower supporting base or socle 9, so to prevent/minimize the air leakages through the gaps

formed between the edge of the lower supporting base or socle 9 delimiting each pass-through opening 19a and the corresponding connecting pipe or pipes 19 sticking out from the same pass-through opening 19.

[0057] In other words, in the example shown the auxiliary lid or cover 9c is preferably shaped so as to at least partly surround/embrace, when fixed onto the lower half-shell 9a and/or the upper half-shell 9b, all connecting pipes 19 of the heat-pump assembly 14 that stick out through the various pass-through slots or recesses 19a, so as to at least partly close/cover the gap between each connecting pipe 19 and the surrounding body of the half-shell 9a, 9b.

[0058] With reference to Figures 2, 3 and 5, in the example shown all pass-through slots or recesses 19a are preferably formed on the upper half-shell 9b, along the coupling edge 20 of the upper half-shell 9b that is structured for abutting/meshing with the lower half-shell 9a, and the auxiliary lid or cover 9c is fixable onto the upper half-shell 9b, immediately above all pass-through slots or recesses 19a, so as to at least partly surround/embrace, when fixed onto the upper half-shell 9b, all connecting pipes 19 that stick out of the upper half-shell 9b through said pass-through slots or recesses 19a, so to at least partly close/cover the gap between each connecting pipe 19 and the surrounding edge of the half-shell 9a, 9b.

[0059] In other words, the auxiliary lid or cover 9c is structured so as to substantially airtight seal the gaps formed between the edge of the upper half-shell 9b delimiting each pass-through slot or recess 19a and the corresponding connecting pipe or pipes 19 sticking out from the same pass-through slot or recess 19, to prevent/minimize the air leakages through these gaps.

[0060] With reference to Figures 2, 3 and 6, in the example shown, the auxiliary lid or cover 9c preferably comprises an elongated element 21 which is structured for being fixed on the outer surface of the upper half-shell 9b, immediately upwards and crosswise of all pass-through slots or recessed 19a formed on the upper half-shell 9b, i.e. immediately over the coupling edge 20 of the upper half-shell 9b; and a number of substantially hook-shaped winglets 22 each of which protrudes from the side edge of the aforesaid elongated plate element 21 towards a corresponding beneath-located pass-through slot or recess 19a, and is shaped to at least partly surround/embrace the connecting pipe 19 of the heat-pump assembly 14 that sticks out of said beneath-located pass-through slot or recess 19a.

[0061] The width of each hook-shaped winglet 22 is suitably dimensioned to locally close/cover the gap between the connecting pipe 19 and the surrounding edge of the upper half-shell 9b.

[0062] With reference to Figure 2 and 5, in the example shown the lower side edge of the elongated plate element 21 is preferably firmly insertable/fitable into a number of vertical pass-through slits or grooves formed on top end of a number of substantially vertically-oriented stiffening ribs 21a (two in the example shown) that protrude outwards from the upper half-shell 9b. The top ends of these stiffening ribs 21a are located immediately over the pass-through slots or recessed 19a formed on the upper half-shell 9b.

[0063] Preferably the vertically-oriented stiffening ribs 21a are also structured to facilitate the centring of the elongated plate element 21 on the upper half-shell 9b and/or to prevent any longitudinal or transversal displacement of the elongated plate element 21 on the upper half-shell 9b.

[0064] Each hook-shaped winglet 22 instead is preferably provided with one or more snap-on locking splines 23 that protrudes from the distal end of the winglet main body remaining locally substantially perpendicular to the reference laying plane of the same winglet. Each locking spline 23 is shaped to hook onto the side edge of the upper half-shell 9b delimiting the pass-through slot or recess 19a to be closed, so as to hold the hook-shaped winglet 22 locally adherent to the outer surface of the upper half-shell 9b.

[0065] Alike lower half-shell 9a and upper half-shell 9b, also the auxiliary lid or cover 9c is preferably, though not necessarily, made of plastic material preferably by means of an injection molding process.

[0066] With reference to Figures 2, 3, 5, and 6, preferably the auxiliary lid or cover 9c also comprises a number of substantially hook-shaped clip elements 24 that protrude from a same face of the elongated plate element 21, preferably remaining locally substantially aligned to the mid line of the elongated plate element 21. Each clip element 24 is structured to hold one or more electric cables or similar.

[0067] With reference to Figures 1, 2, 3 and 4, the centrifugal fan 13 instead preferably comprises an outer housing or impeller housing 25 which is located on the back of the lower supporting base or socle 9, at the end-opening of the central/intermediate segment 12c of the air recirculating conduit 12, so to directly communicate, i.e. be flowingly/fluidly connected to, both the central segment 12c of the air recirculating conduit 12 and the inside of revolving drum 3; and an impeller 26 which is housed in axially rotating manner inside the outer housing 25 to generate the airflow f when rotating about its reference axis A.

[0068] In the example shown, the electric motor 5 is preferably fixed/recessed on the lower supporting base or socle 9 so that its drive shaft 5a sticks out from the back of the lower supporting base or socle 9, at the end-opening of the central segment 12c of the air recirculating conduit 12; and the centrifugal fan 13 is mechanically connected to the electric motor 5.

[0069] With reference to Figure 4, in the examples shown, the centrifugal fan 13 is preferably located on the back of the lower supporting base or socle 9, locally substantially aligned to the drive shaft 5a of electric motor 5, so that the outer housing 25 is locally substantially coaxial to the drive shaft 5a of electric motor 5, and the impeller

26 is rigidly fitted to the axial end of the drive shaft 5a of electric motor 5 so to be directly driven into rotation by the latter.

[0070] Furthermore, with reference to Figures 3 and 4, in the example shown the outer housing or impeller housing 25 of centrifugal fan 13 is preferably also at least partly integrated on the back of the lower supporting base or socle 9 formed by the two half-shells 9a and 9b.

[0071] In other words, the impeller housing 25 of centrifugal fan 13 comprises a first portion 25a directly incorporated in the lower supporting base or socle 9, at the end-opening of the central segment 12c of the air recirculating conduit 12, and a second portion 25b which is structured/shaped for being coupled in a rigid and stable, though easily releasable, manner to the first portion 25a of the impeller housing so to close the first portion 25a of the impeller housing for covering up the impeller 26 that is at least partly recessed inside the first portion 25a of outer housing 24.

[0072] The first portion 25a of outer or impeller housing 25 is preferably made in one piece with the lower supporting base or socle 9, whereas the second portion 25b of the impeller housing consists in a substantially basin-shaped, rigid cover 25b which is fixed in a rigid and stable, though easily releasable, manner to the area of the lower supporting base or socle 9 forming the first portion 25a of outer or impeller housing 25, so as to substantially airtight close said first portion 25a and completely cover the impeller 26.

[0073] In the example shown, the first portion 25a of the impeller housing 25 of centrifugal fan 13 is preferably divided into two distinct and separated sections which are made in one piece, respectively, with the lower half-shell 9a and with the upper half-shell 9b, so that the whole first portion 25a of the impeller housing 25 is formed when the two half-shells 9a and 9b are coupled to one another.

[0074] In the example shown, the aforesaid two distinct and separated sections forming the first portion 25a of the impeller housing 25 are preferably structured and shaped so as to form, when firmly coupled to one another, a first approximately half-volute of the impeller housing 25; whereas the second portion 25b of impeller housing preferably consists in a substantially basin-shaped, rigid cover 25b which is shaped so as to form the remaining, complementary second half-volute of the impeller housing 25, and is structured for being substantially airtight coupled to the first half-volute 25a formed by the two half-shells 9a and 9b, to complete the outer housing 25 of centrifugal fan 13.

[0075] In other words, the impeller housing 25 of centrifugal fan 13 is spitted into three distinct and separated pieces which are structured for being coupled to one another to form the whole volute of the impeller housing 25.

[0076] In addition to the above, with reference to Figures 3 and 4, in the example shown the lower half-shell 9a and upper half-shell 9b are also preferably, though not necessarily, structured so that the central segment 12c of the air recirculating conduit 12 is substantially L-shaped, and is oriented so that a first portion of the central segment of the air recirculating conduit 12 extends below the revolving drum 3 while remaining locally substantially parallel to the longitudinal axis L of revolving drum 3, and that a second transversal portion of the central segment of the air recirculating conduit 12 extends below the revolving drum 3 remaining locally substantially perpendicular to the longitudinal axis L of drum 3.

[0077] The evaporator 15 and the condenser 16 are located, one downstream the other, inside the first portion of the central segment 12c of the air recirculating conduit 12; whereas the refrigerant compressing device 17 and the electric motor 5 are preferably fixed/recessed on the lower supporting base or socle 9, aligned one after the other in a direction locally substantially parallel to the longitudinal axis L of revolving drum 3, beside the first portion of the central segment 12c of the air recirculating conduit 12, so that the drive shaft 5a of electric motor 5 sticks out from the back of the lower supporting base or socle 9, at the end of the second portion of the central segment 12c of the air recirculating conduit 12.

[0078] In the example shown, electric motor 5 and refrigerant compressing device 17 are preferably fixed/recessed directly onto the lower half-shell 9a, beside the first portion of the central segment 12c of the air recirculating conduit 12.

[0079] As regards the pass-through slots or recesses 19a, they are made on the flank of the upper half-shell 9b that is directly faced to the refrigerant compressing device 17 and the electric motor 5.

[0080] With reference to Figure 4, the centrifugal fan 13 is therefore located on the back of the lower supporting base or socle 9, at the end of the transversal second portion of the central/intermediate segment 12c of the air recirculating conduit 12 that extend through the lower supporting base or socle 9, locally aligned to the drive shaft 5a of the electric motor 5.

[0081] General operation of the rotary-drum home laundry drier 1 is clearly inferable from the above description, with no further explanation required.

[0082] As regards the auxiliary lid or cover 9c, it allows to prevent/minimize the air leakages through the pass-through slots or recesses 19a made along the air recirculating conduit 12 in a simple ad cost-effective way, thus greatly simplify the assembly of the lower supporting base or socle 9 and the portion of the hot-air generator 6 located therein.

[0083] Clearly, changes may be made to the rotary-drum laundry drier 1 as described herein without, however, departing from the scope of the present invention.

[0084] For example in a non-shown less sophisticated embodiment, the auxiliary lid or cover 9c may be firmly fixed on the lower half-shell 9a and/or the upper half-shell 9b via rivets, screws and similar.

[0085] In addition, in a further non-shown embodiment, the lower supporting base or socle 9 of casing 2 may comprise two or more upper half-shells 9b which are structured for being stacked up on top of, and rigidly cou-

pled to, the lower half-shell 9a, so as to form/compose different sections of the central/intermediate segment 12c of the air recirculating conduit 12. The evaporator 15 and the condenser 16 of heat-pump assembly 14 may be recessed into sections of the central/intermediate segment 12c of the air recirculating conduit 12 delimited by different upper half-shells 9b.

[0086] Lastly, the auxiliary lid or cover 9c may be used to close/cover one or more pass-through openings 19a formed on the lower supporting base or socle 9 to allow the passage of one or more electric wires, probes, sensors and/or other elongated/oblong elements that have to reach the inside of the central/intermediate segment 12c of the air recirculating conduit 12.

[0087] In other words, the lower half-shell 9a and/or the upper half-shell 9b may have one or more pass-through openings 19a shaped/dimensioned to allow the passage of one or more electric wires, sensors, probes and/or other elongated/oblong elements that have to reach the inside of the central/intermediate segment 12c of the air recirculating conduit 12, and the auxiliary lid or cover 9c may be structured to prevent/minimize the air leakages through the gaps formed between the edges of half-shell 9a or 9b delimiting one or more pass-through openings 19a and the electric wires, sensors, probes and/or other elongated/oblong elements that stick out from these pass-through opening 19a.

[0088] For example, in an alternative embodiment the closed-circuit, hot-air generator 6 may consist of a forced-air, hot-air generator in which the cooling of the airflow f arriving from the revolving drum 3 is performed via a cold airflow arriving from the outside of casing 2.

[0089] In this case, the hot-air generator 6 lacks the heat-pump assembly 14 (i.e. it lacks the evaporator 15, the condenser 16, the refrigerant compressing device 17, the refrigerant expansion device 18, and the connecting pipes 19), and instead comprises an air/air heat exchanger which is located along the central/intermediate segment 12c of the air recirculating conduit 12, in place of the evaporator 15; and a resistor or similar air-heating device which is located along the air recirculating conduit 12, downstream of said air/air heat exchanger.

[0090] Additionally one or more pass-through openings 19a are realized on the lower supporting base or socle 9 to allow the entrance of the electric wires that, for example, power the resistor or transmit electronic signals from an internal sensor or probe to the electronic central control unit 7. The auxiliary lid or cover 9c is fixed to the lower supporting base or socle 9 above said pass-through openings 19a to prevent/minimize the air leakages through the gaps formed between the edges of the lower supporting base or socle 9 delimiting said pass-through openings 19a and the electric wires that stick out from these pass-through opening 19a.

[0091] Alternatively one or more sensors, probes and/or other elongated/oblong elements may extend in pass-through manner across the aforesaid pass-through openings 19a, and the auxiliary lid or cover 9c is fixed to the lower supporting base or socle 9 above these pass-through openings 19a to prevent/minimize the air leakages through the gaps formed between the edges of the lower supporting base or socle 9 delimiting said pass-through openings 19a and the sensors, probes and/or other elongated/oblong elements.

Claims

1. Rotary-drum laundry dryer (1) comprising a revolving drum (3) adapted to receive laundry to be dried, a hot-air generator (6) structured to circulate an airflow (f) through said revolving drum (3), and a lower supporting base or socle (9) which is structured for resting on the floor and for housing at least part of the hot-air generator (6);
the hot-air generator (6) comprising: an air recirculating conduit (12) allowing said airflow (f) to flow through the revolving drum (3) and through at least one heat exchanger (15) located along said air recirculating conduit (12) for condensing moisture inside the airflow (f);
a segment (12c) of the air recirculating conduit (12) extending across the lower supporting base or socle (9), and being structured so as to house said at least one heat exchanger (15); said lower supporting base or socle (9) being furthermore provided with one or more pass-through openings (19a) through which corresponding elongated members (19) stick out of said segment (12c) of the air recirculating conduit (12);
the laundry dryer (1) **being characterized by** comprising an auxiliary lid or cover (9c) which is structured for being associated onto the lower supporting base or socle (9), in a region adjacent to at least one of said pass-through openings (19a), to at least partly cover/close the gap formed between the edge of the lower supporting base or socle (9) delimiting said pass-through opening (19a) and the at least one elongated member (19) that sticks out of the lower supporting base or socle (9) through said pass-through opening (19a).

2. Rotary-drum laundry dryer according to Claim 1, **characterized in that** said auxiliary lid or cover (9c) is shaped so to at least partly surround/embrace, when fixed on the lower supporting base or socle (9), the at least one elongated member (19) that sticks out of the corresponding pass-through opening (19a).

3. Rotary-drum laundry dryer according to Claim 1 or 2, **characterized in that** said auxiliary lid or cover (9c) is shaped/structured to cover all pass-through openings (19a) on the lower supporting base or socle (9), to at least partly cover/close the gap formed between the edge of the lower supporting base or socle

(9) delimiting each pass-through opening (19a) and the at least one elongated member (19) that sticks out of the lower supporting base or socle (9) through the corresponding pass-through opening (19a).

4. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** said auxiliary lid or cover (9c) is associated to the lower supporting base or socle (9) via snap-on locking means (23).

5. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the lower supporting base or socle (9) comprises a lower half-shell (9a) which is structured for resting on the floor, and at least one upper half-shell (9b) which is structured/ shaped for being stacked up on top of, and rigidly coupled to, said lower half-shell (9a), so to form at least a portion of said segment (12c) of the air recirculating conduit (12); the pass-through openings (19a) of the lower supporting base or socle (9) consisting in one or more pass-through slots or recesses (19a) made on the lower half-shell (9a) and/or on the at least one upper half-shell (9b), along a coupling edge (20) between said half-shells (9a, 9b).

6. Rotary-drum laundry dryer according to Claim 5, **characterized in that** the lower half-shell (9a) and the at least one upper half-shell (9b) are made of plastic material via an injection molding process.

7. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** said auxiliary lid or cover (9c) comprises an elongated plate element (21) which is structured for being fixed on the outer surface of the lower supporting base or socle (9), immediately upwards and crosswise of a plurality of pass-through openings (19a) of the lower supporting base or socle (9); and a number of substantially hook-shaped winglets (22) each of which protrudes from said elongated plate element (21) towards a corresponding beneath-located pass-through opening (19a), and is shaped to at least partly surround/embrace the elongated member (19) that sticks out of said beneath-located pass-through opening (19a).

8. Rotary-drum laundry dryer according to Claim 7, **characterized in that** a side edge of the elongated plate element (21) of said auxiliary lid or cover (9c) is insertable into a number of vertical pass-through slits or grooves made on top end of a number of protruding appendixes (21a) that jut out from the lower supporting base or socle (9).

9. Rotary-drum laundry dryer according to Claim 7 or 8, **characterized in that** the elongated plate element (21) of said auxiliary lid or cover (9c) also comprises a number of substantially hook-shaped clip means (24) that protrude from a same face of the elongated plate element (21).

10. Rotary-drum laundry dryer according to Claim 7, 8 or 9, **characterized in that** at least one of the hook-shaped winglets (22) of said auxiliary lid or cover (9c) is provided with one or more snap-on locking splines (23) that protrudes from the distal end of the winglet main body remaining locally substantially perpendicular to the reference laying plane of the same winglet (22); each locking spline (23) is shaped to hook onto the side edge of the lower supporting base or socle (9) delimiting the pass-through opening (19a) to be closed, so as to hold the hook-shaped winglet (22) locally adherent to the outer surface of the lower supporting base or socle (9).

11. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** said auxiliary lid or cover (9c) is made of plastic material by an injection molding process.

12. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the hot-air generator (6) is a heat-pump type, hot-air generator (6) which comprises:

- a first air/refrigerant heat exchanger (15) which is located inside said segment (12c) of the air recirculating conduit (12), and is structured for rapidly cooling down the airflow (f) arriving from the revolving drum (3) to condense and restrain the surplus moisture in the airflow (f);
- a second air/refrigerant heat exchanger (16) which is located inside said segment (12c) of the air recirculating conduit (12), downstream of the first air/refrigerant heat exchanger (15), and which is structured for rapidly heating the airflow (f) arriving from the first air/refrigerant heat exchanger (15) and directed back to the revolving drum (3);
- a refrigerant compressing device (17) which is interposed between the refrigerant-outlet of the first air/refrigerant heat exchanger (15) and the refrigerant-inlet of the second air/refrigerant heat exchanger (16), and which is structured for compressing the gaseous-state refrigerant directed towards the second air/refrigerant heat exchanger (18); and
- a refrigerant expansion device (18) which is interposed between the refrigerant-outlet of the second air/refrigerant heat exchanger (16) and the refrigerant-inlet of the first air/refrigerant heat exchanger (15), and it is structured so as to cause a rapid expansion of the refrigerant directed towards the first air/refrigerant heat ex-

changer (17).

13. Rotary-drum laundry dryer according to Claims 12, **characterized in that** said heat-pump type, hot-air generator (6) furthermore comprises a number of connecting pipes (19) that connect the first heat exchanger (15), the second heat exchanger (16), the refrigerant compressing device (17) and the refrigerant expansion device (18) to one another; and that at least one of said elongated member (19) consists in one of said connecting pipes (19)

14. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** at least one of said elongated member (19) consists in an electric wire or similar that sticks out of the lower supporting base or socle (9) through a pass-though opening (19a).

15. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** at least one of said elongated member (19) consists in a sensor, probe and/or other oblong element that extend in pass-through manner across a corresponding pass-through opening (19a).

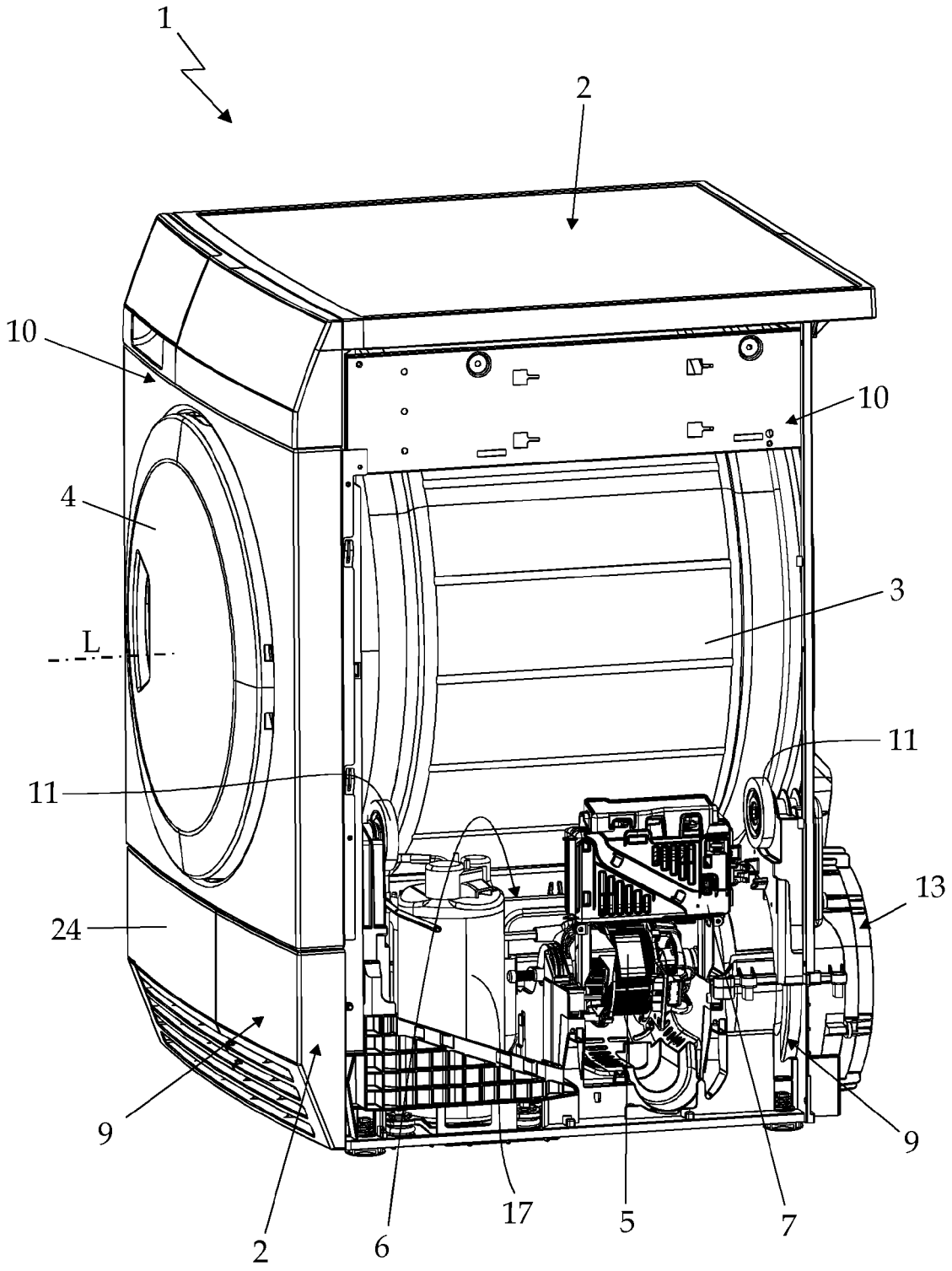
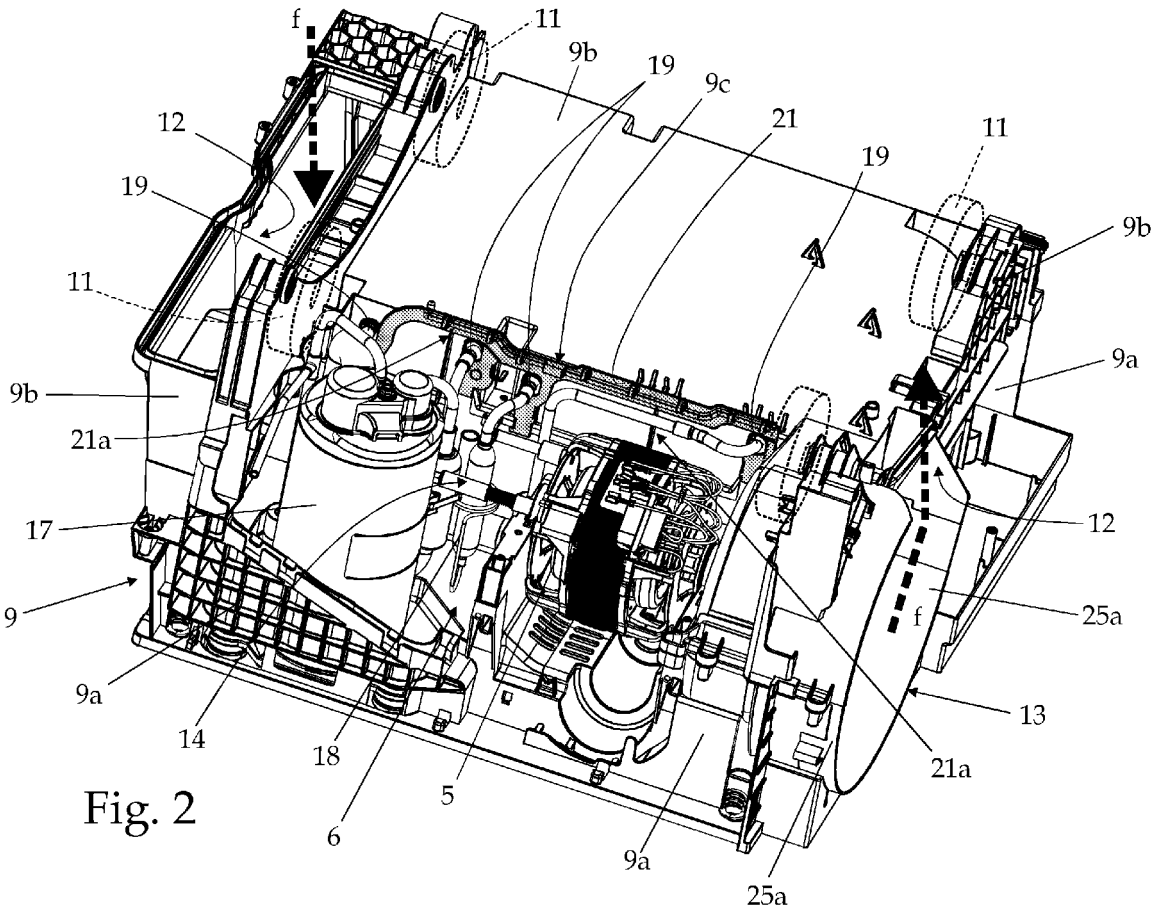


Fig. 1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9a
25a

Fig. 2

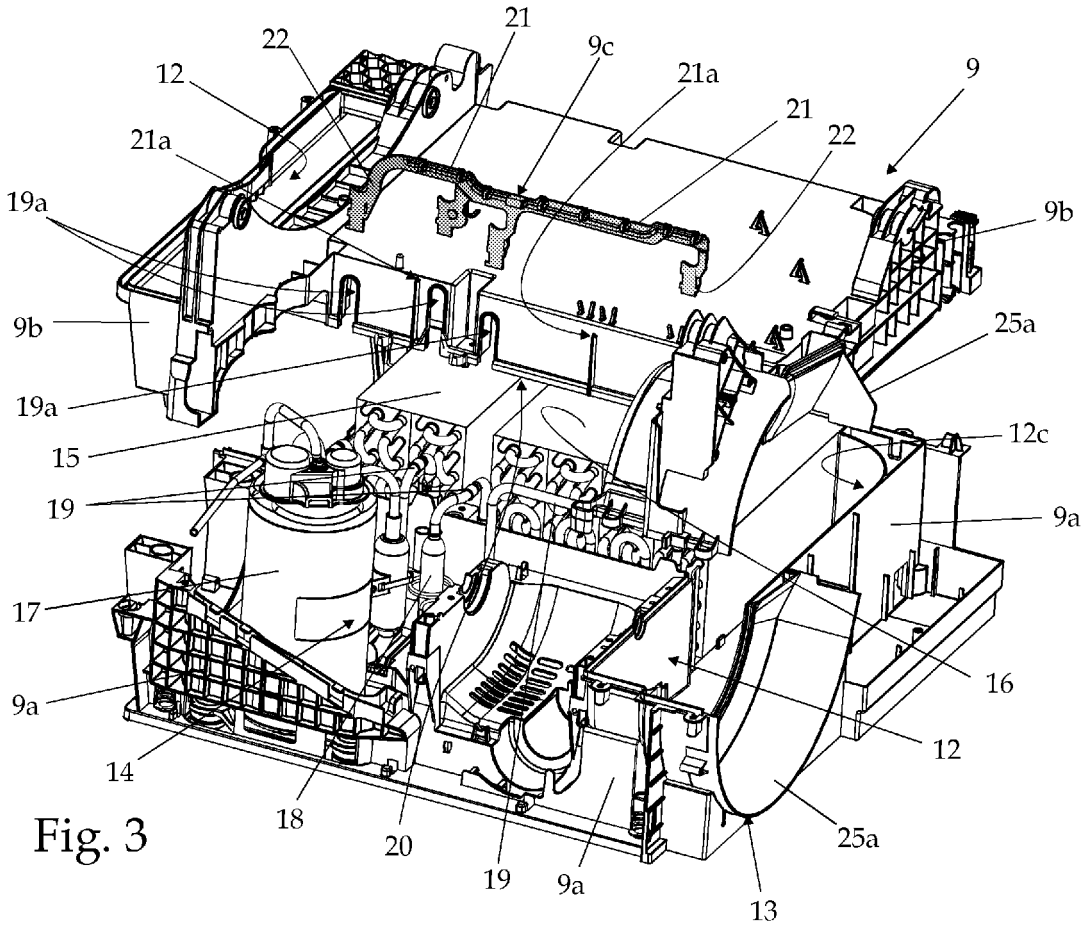
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Fig. 3

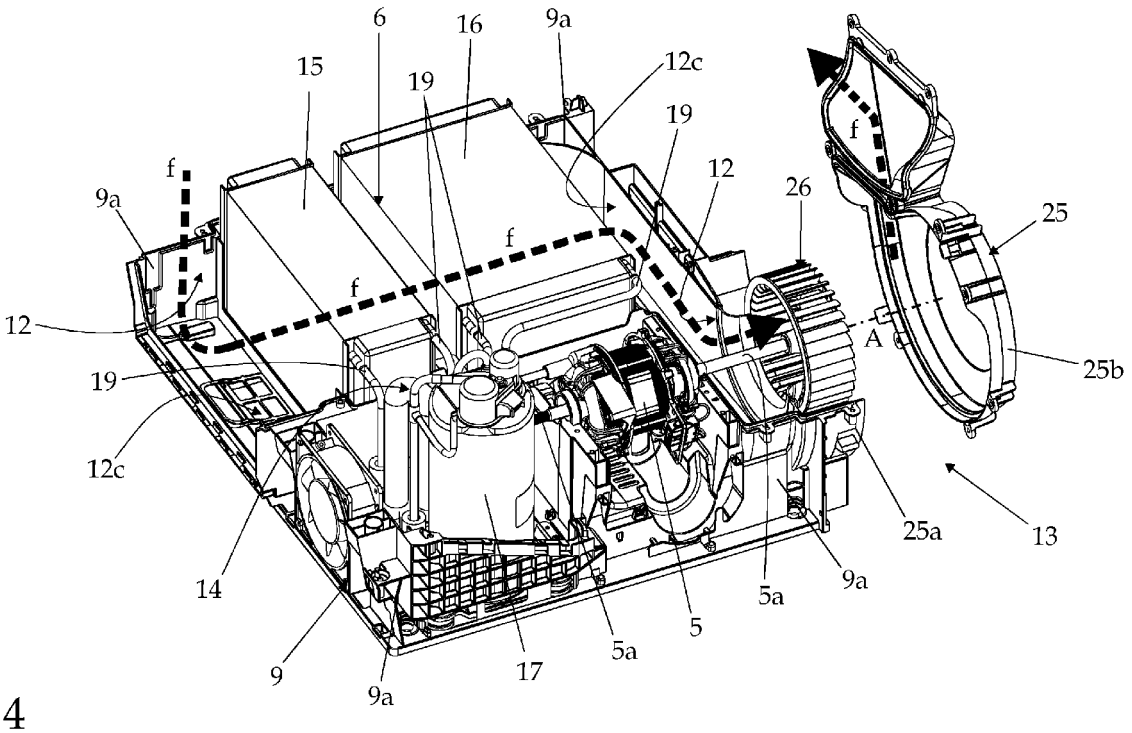
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Fig. 4

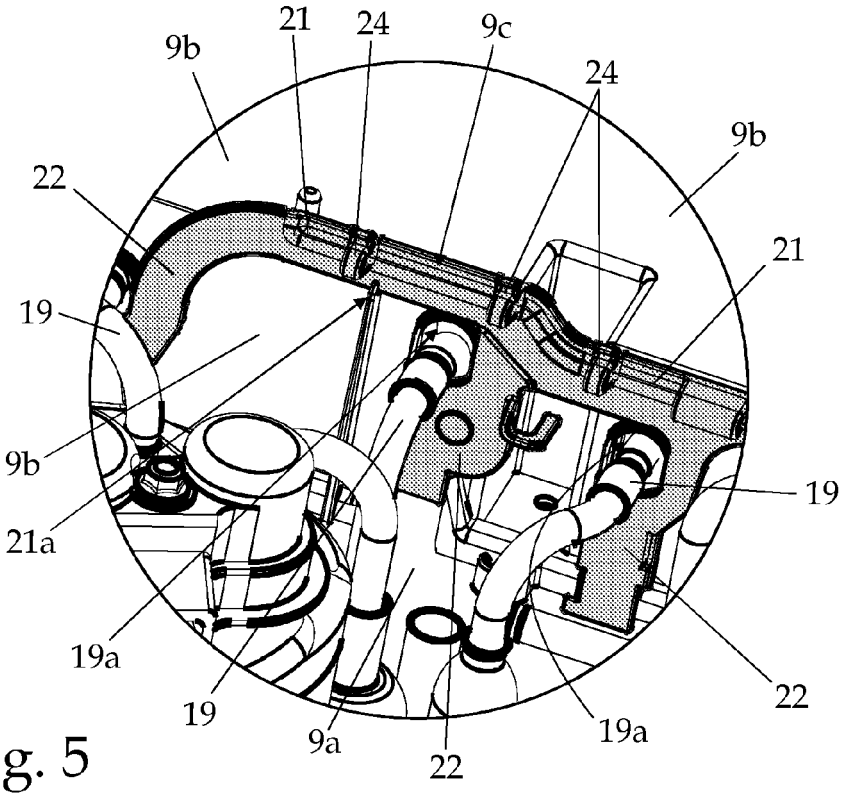
9b
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Fig. 5

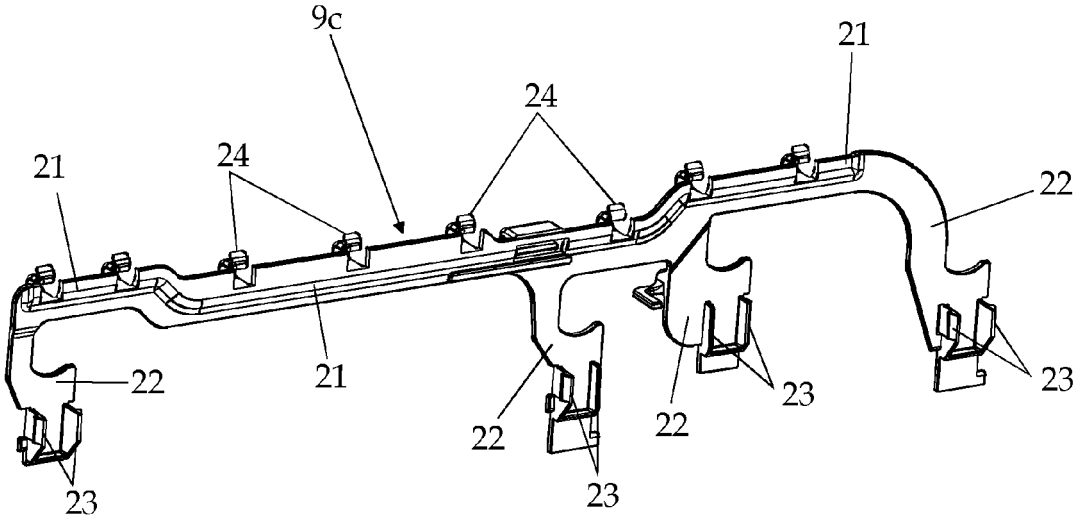
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Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 7977

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 312 049 A1 (ELECTROLUX HOME PROD CORP [BE]) 20 April 2011 (2011-04-20) * figures 2,3 *	1-15	INV. D06F58/20
A,D	DE 20 2006 018205 U1 (V ZUG AG [CH]) 15 February 2007 (2007-02-15) * paragraph [0013] - paragraph [0035]; figures 1-5 *	1-15	
A	EP 1 209 277 A2 (ELECTROLUX ZANUSSI ELETTRODOME [IT]) 29 May 2002 (2002-05-29) * figures 2,3 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 November 2011	Hannam, Martin

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Application Number
EP 11 16 7977

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TECHNICAL FIELDS SEARCHED (IPC)

D06F

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04-11-2011

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